

Technological challenges for Arctic shipping

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 **SINTEF**

Technological challenges

- Communication
- Search and rescue
- Ports

Example – vessel stranded at 74°N

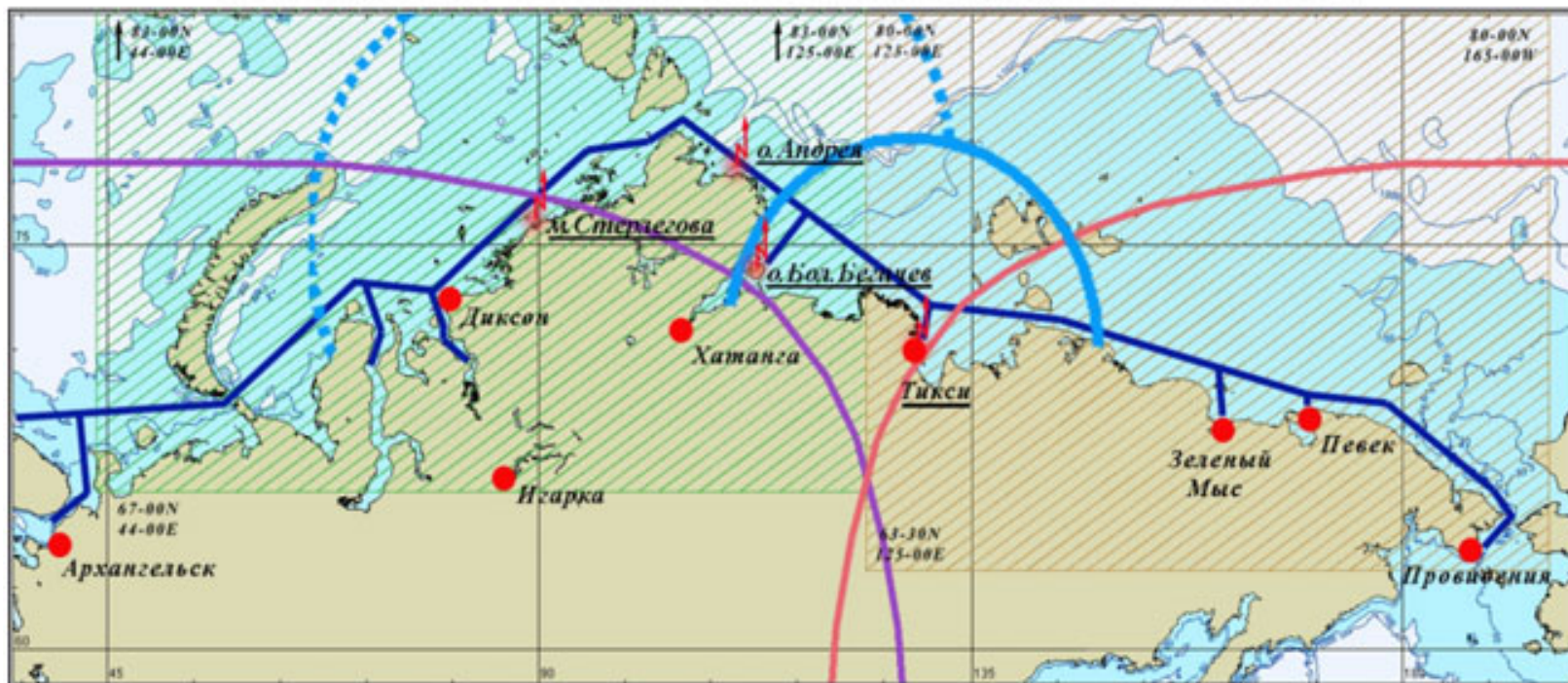


Arctic communication challenges

	Systems	Characteristics	(> 80° N)	(70° N - 80° N)	(< 70° N)
Terrestrial systems	HF, MF	Safety related messages and voice communication	Low reliability and unsuitable for digital communications	Low reliability	OK, but unsuitable for digital communications
	VHF,	Line-of-sight (30 nautical miles), voice and low data rate communications	Ship-to-ship communication is OK. No connection to land based stations	Connection to a small number of land based stations. Ship-to-ship OK	OK close to the coast.
	GSM, 3G	Line-of-sight (30 nautical miles), voice and data rate communications	No connection to land based stations	Connection to very few land based stations	Limited coastal coverage. Connection to land based stations making the system suitable near the coast.
Satellite systems	GEO satellites, including Inmarsat	Medium capacity. Low to medium latency	Not available	Potential problems with quality and availability	OK (except in fjords and similar special areas)
	LEO satellittes; Iridium, OpenPort	Currently max. 128 kbps. High and variable latency	Potential problems with quality	Potential problems with quality	OK
	HEO Satellites	Properties comparable to GEO. Currently unavailable	Expected to provide coverage, capacity and quality in the Polar and Sub-Polar areas. Spare capacity can be used in other sea areas. Not yet implemented.		

Inmarsat coverage Russian Arctic

Северный морской путь Зоны приема ИБМ по системам SafetyNET и Navtex



Условные обозначения:

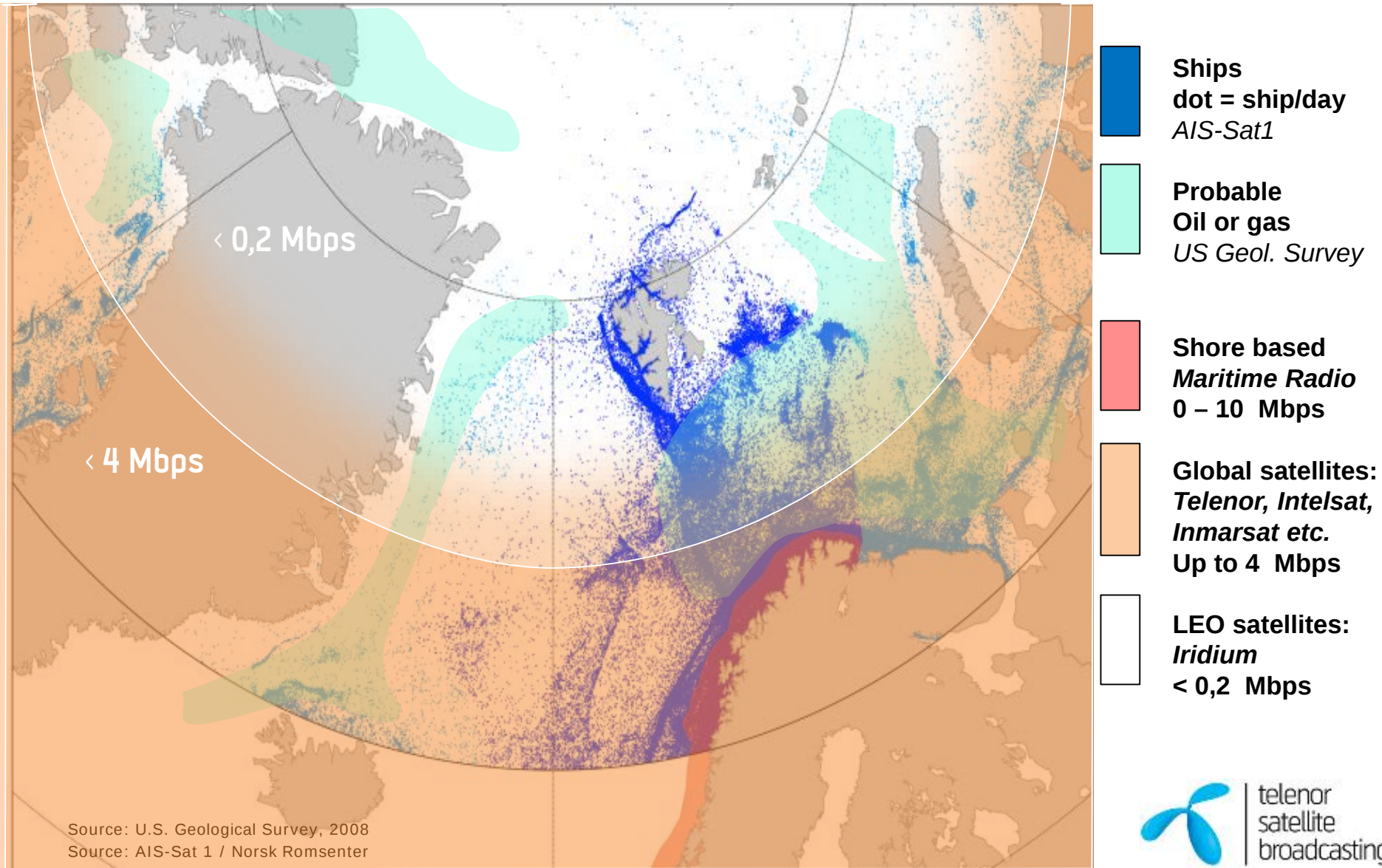
- - Арктические филиалы
Гидрографического предприятия
- - Традиционная трасса Северного
Морского Пути

- - ориентир. зона действия спутника
Индийского океана SafetyNET IOR
- - ориентир. зона действия спутника
Тихого океана SafetyNET POR



- Тикси - установленные станции Navtex
(с зоной действия 350 миль)
- о. Андрея - планируемые станции Navtex
(с зоной действия 350 миль)

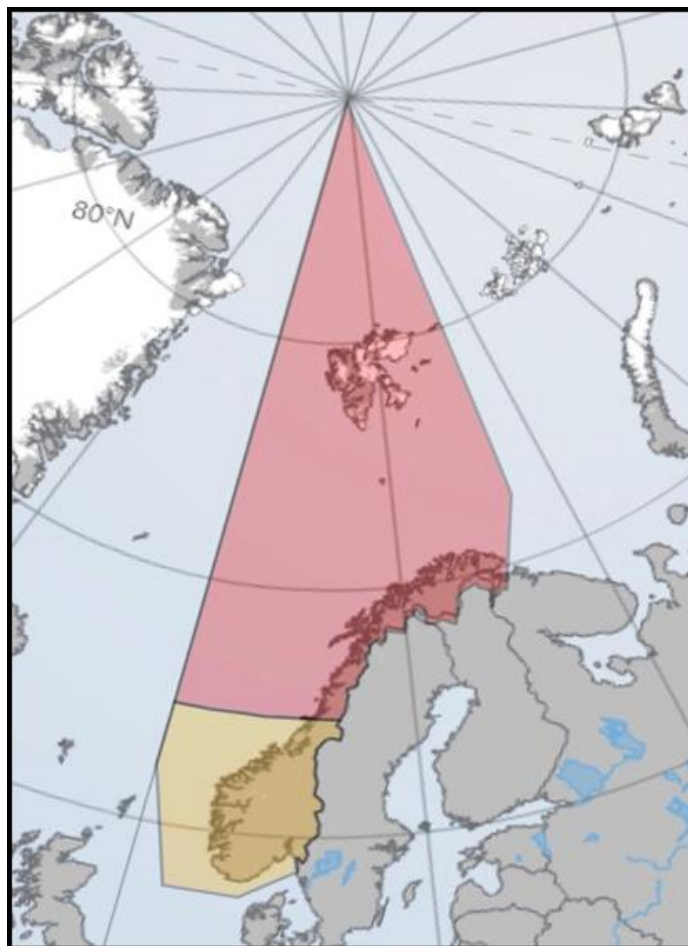
Challenges facing Arctic SAR operations - Communication



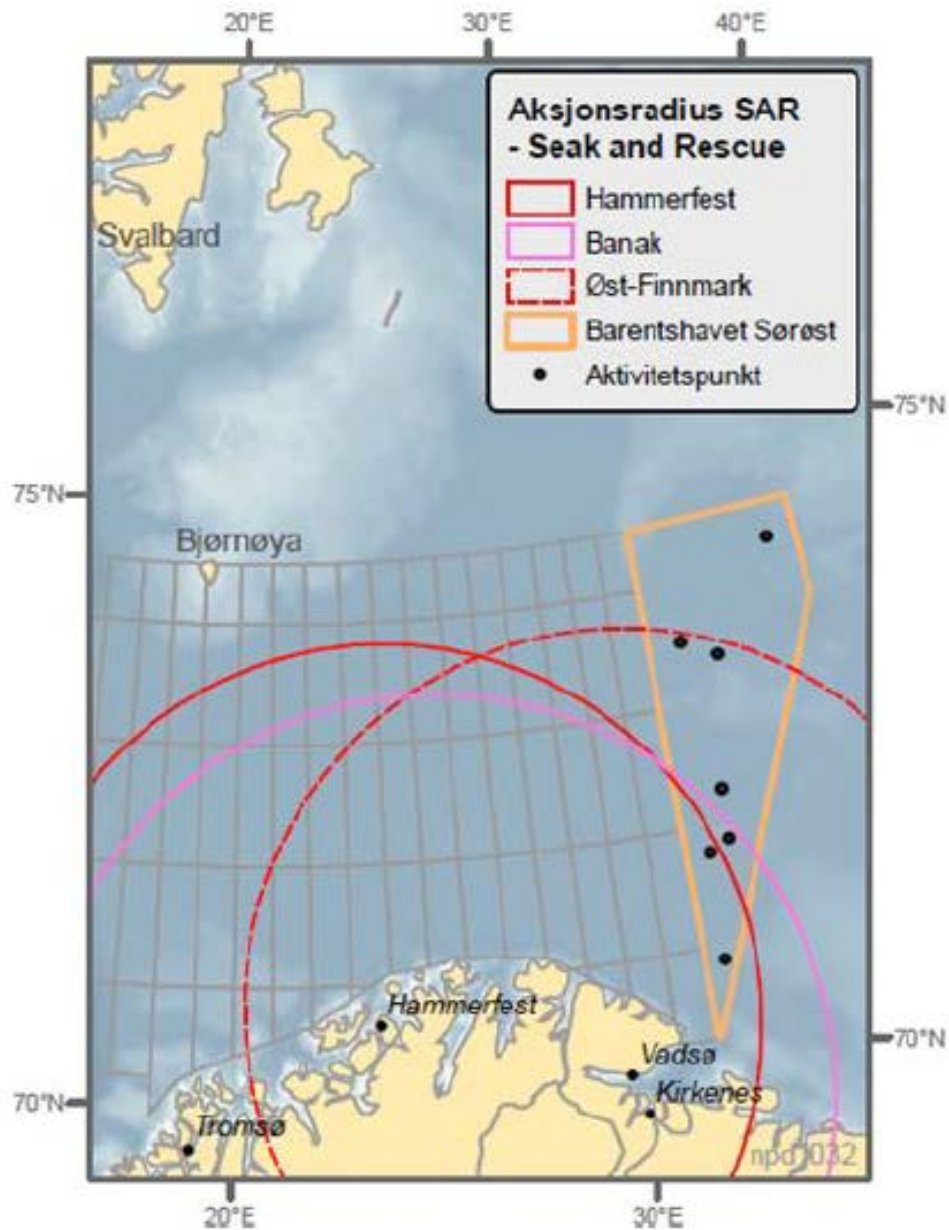
SAR responsibility areas – Nuuk agreement 2011



Joint rescue coordination centres



Helicopter resources



Russian regulatory structure

Ministry of Transport (**Mintrans**)

Federal agency of maritime and river transport
(**Rosmorrechflot**)

Federal Autonomous
Enterprise "Russian
Maritime Register of
Shipping"
(**RS**)

Federal State-Owned
Institution "The
Northern Sea Route
Administration"
(**NSRA**)

Federal State Unitary
Enterprise
"Rosmorport"

Federal Budgetary
Enterprise "State Marine
Emergency Salvage, Rescue
and Pollution Prevention
Coordination Service"
(**Gosmorspassluzhba**)

Federal State Unitary
Enterprise
"Hydrographic
Department"

Actuals 2013 – Russian government structure

Ministry of
Defence of the
Russian
Federation
(**Minoborony**)

Ministry of Affairs
for Civil Defence,
Emergencies and
Elimination of
Consequences of
Natural Disasters
(**EMERCOM**)

Federal Security
Service of Russia
(**FSB**)

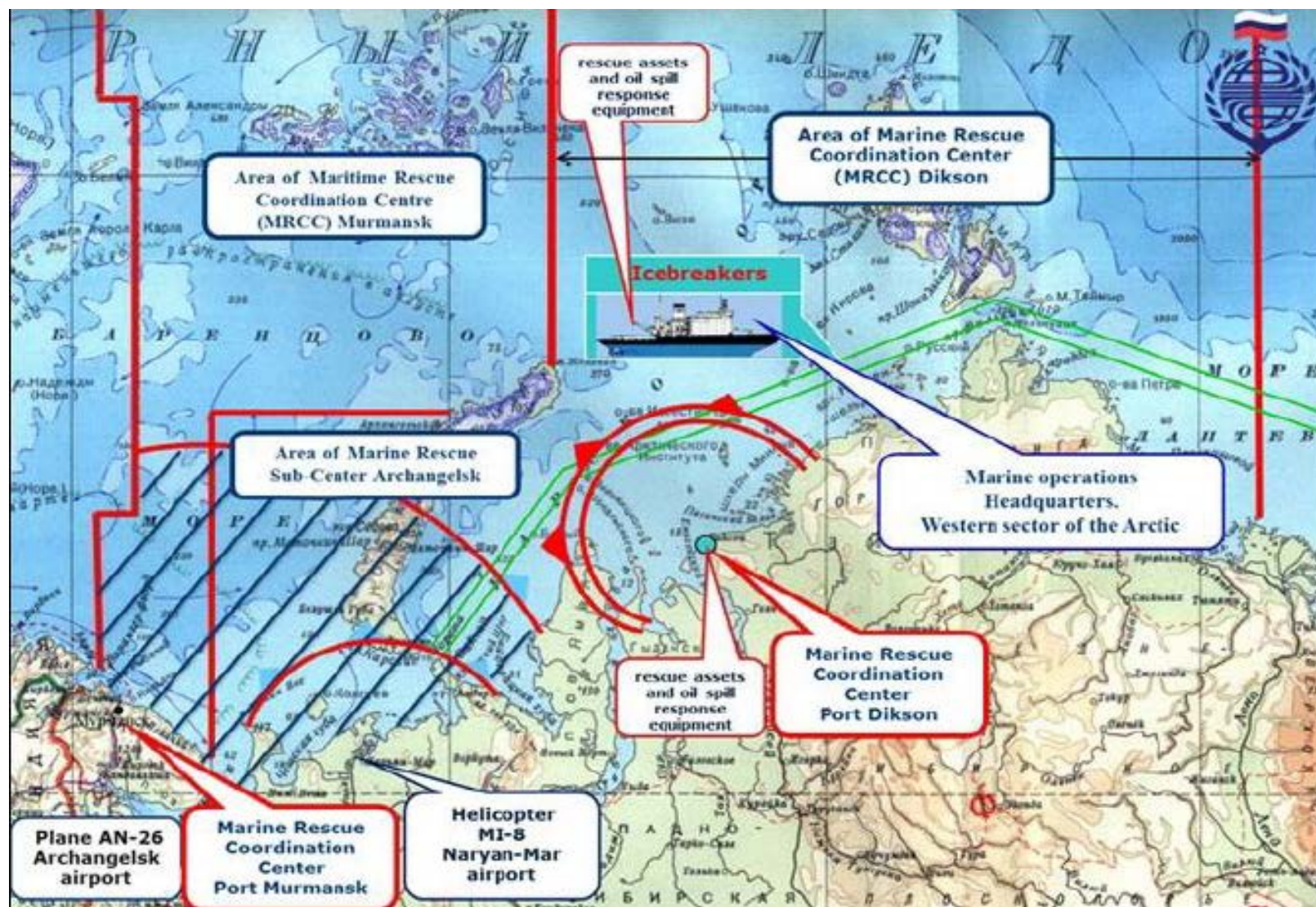
Ministry of
Natural
Resources and
Environment
(**Minprirody**)

Department of
Navigation
and
Oceanography
(**Hydrographic
service**)

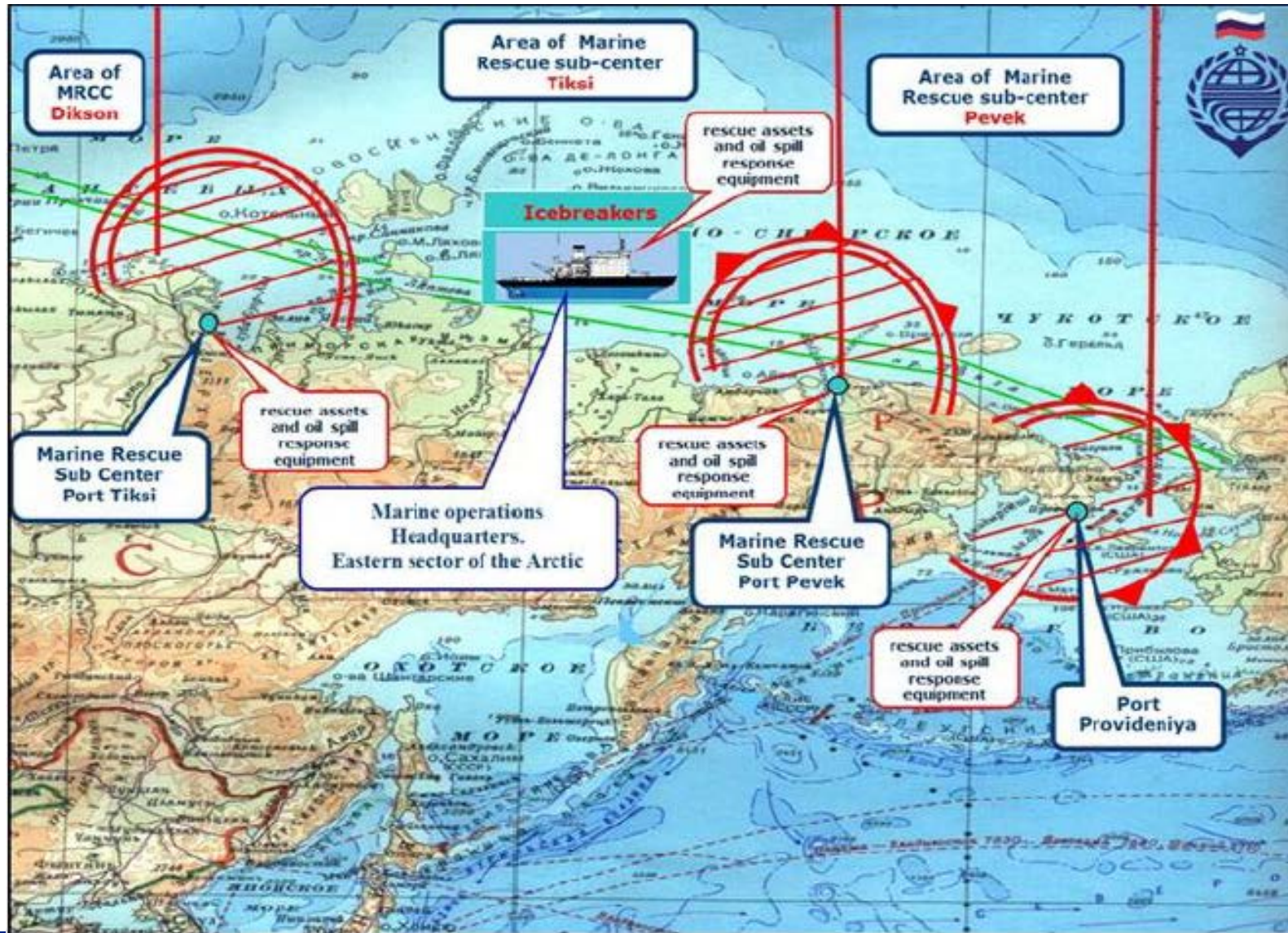
Russian Coast
Guard

Federal Service for
Hydrometeorology
and Environmental
Monitoring
(**Roshydromet**)

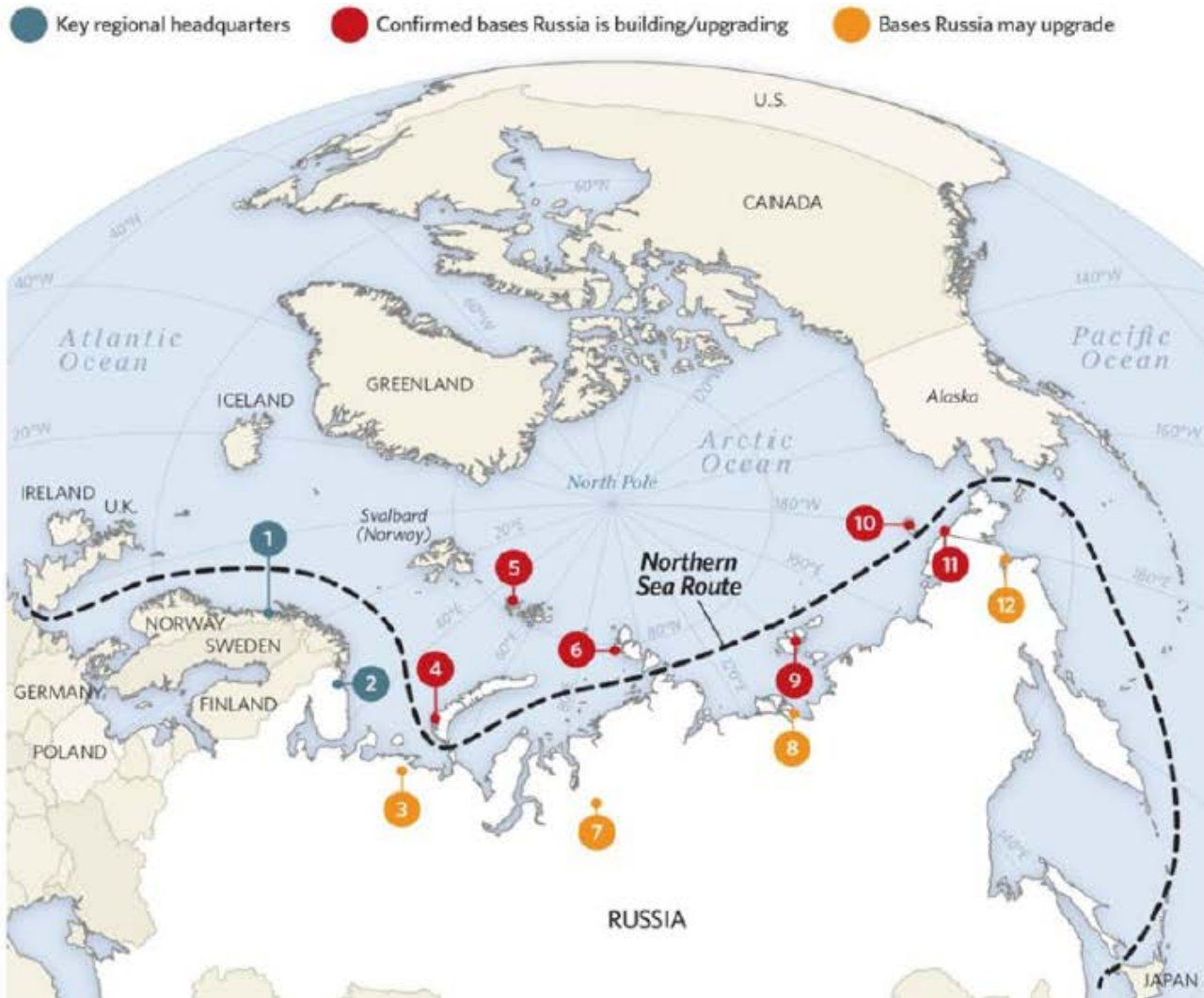
SAR capability – Russian Arctic west



SAR capability – Russian Arctic east



Russian military development in the Arctic



Russian civilian & military bases in the Arctic

Key Locations

- | | |
|--|-----------------|
| 1 Bode, Norway's National Joint Headquarters | 6 Sredny Ostrov |
| 2 Severomorsk, home of Russia's Northern Fleet | 7 Alykel |
| 3 Naryan-Mar | 8 Tiksi |
| 4 Rogachevo | 9 Temp |
| 5 Nagurskoye | 10 Zvyozdny |
| | 11 Mys Shmidta |
| | 12 Ugolny |



Source: CHNL, 2015

Some final points

- There are large needs for research technological solutions for the Arctic
- There are a lot of ongoing work amongst authorities and regulatory bodies on specifying and defining standards and codes to be followed in these areas, but the technical solutions are not yet in place to provide satisfactory safety for personnel.
- There are challenges in the Arctic related to the different nations that are involved, internal organisation and resources needed to fill the special requirements for SAR operations in the area.
- More cooperation between researchers and final users is always beneficial
- It is important to study and analyse real-life examples and user experiences

A-LEX 2 – MARINTEK publications

Published papers:

- Larsen, L-H., Kvamstad-Lervold, B., Sagerup, K., Gribkovskaia, V., Bambulyak, A., Rautio, R. & T.E. Berg. 2016. ***Technological and environmental challenges of Arctic shipping - A case study of a fictional voyage in the Arctic.*** Polar Research, 35, 27977, <http://dx.doi.org/10.3402/polar.v35.27977>.
- Kisialiou, Y., Gribkovskaia, I., Gribkovskaia, V. 2015. ***A simulation model for the assessment of the Northern Sea Route throughput.*** NOFOMA 2015 : Post Conference Proceedings, Molde, 3-5 June 2015, Nordic Logistics Research Network. Nordic Logistics Research Network 2015 ISBN 978-82-7962-207-9. s. 175-189.
- Berg, T. E., Selvik, Ø. 2015. ***Emergency Towing Operations in Arctic Waters.*** OTC Arctic Technology Conference, 23-25 March, Copenhagen, Denmark. Society of Petroleum Engineers 2015 ISBN 978-1-61399-431-3.
- Selvik, Ø., Berg, T. E., Fathi, D. E. 2015. ***Drifting Paths of Disabled Vessels.*** Proceedings ASME 2015 34th International Conference on Ocean, Offshore and Arctic Engineering Volume 7: Ocean Engineering. ASME Press 2015 ISBN 978-0-7918-5655-0.

Project reports/memos:

- Berg, T.E. **Prediction of icing, stability and drift after engine problems**, 2015.
- Berg, T.E. **Status of marine icing**, 2015.
- Gribkovskaia, V. **Russian organisations and documents related to Arctic shipping**, 2014.
- Gribkovskaia, V., Kvamstad, B. **Supporting technologies for safety at sea**, 2014.
- Steinebach, C., Gribkovskaia, V. **GMDSS in the Arctic**, 2014.
- Selvik, Ø., Berg, T.E. **Study of drifting vessels**, 2014.